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**PERSONAL COMMUNICATION DEVICE HAVING A BUILT-IN
PROJECTION DISPLAY**

This present application claims the benefit of the filing date of U.S. Provisional Patent Application Serial No. 60/251,202 filed December 4, 2000.

TECHNICAL FIELD

The present invention generally relates to communication devices, and more particularly, relates to personal communication devices including built-in projection displays.

BACKGROUND INFORMATION

A significant market is under development for compact communication devices combining cellular (or other wireless) telephones with a limited-function computer. An early example of this class of devices being called "personal communicators" is the IBM/Bell-South "SIMON." In its present form, the SIMON adds a relatively small computer (8086-class, moving to 80386-class), plus a backlit, touch-sensitive display to a cellular telephone. This combination of computer, wireless communication, and enabling software creates a powerful productivity tool, which allows a single device

to provide wireless telephony functions, personal information management (e.g., electronic calendar and address/phone number listings), as well as two-way wireless transfer of digital data.

Some of the limitations of these devices have heretofore included the difficulty of viewing the data display while communicating over the phone, the weight and fragility of the relatively large LCD display, the relatively high power required for the back-lit monochrome display, and the even higher cost and power to provide a color display. Further limitations have also included size and human-factor design issues, the ability of the user to manipulate a device with minimal effort, and the preference of a user for easily viewing a display akin to that a user may be accustomed to in a typical office environment. Additionally, users may have difficulty adapting to viewing a display that is substantially smaller than the view they may be accustomed to from their fixed desktop display units.

Furthermore, the touch- and stylus-based user interfaces generally require two hands to operate and preclude the simultaneous use of the phone handset and the computer functions, except in a speaker-phone mode where the user would have to speak to the unit while holding it in front of him. While speech-based operation will be added to these devices in the future, a practical speech-based user interface still requires the user to see a display during use, since the user needs to see the set of allowable selections (the menu items), while for dictation mode, the user would like to see the progress of the speech-to-text translation.

As an alternative to SIMON-like designs that make it difficult to utilize the phone handset in the normal, private (non-speaker-phone) mode while also viewing the display, it has been suggested that the personal communicator should be fashioned like a pair of glasses or goggles, with a view-finder "projection" display and a speaker and microphone all built into the "frames" of the headset. While this interaction paradigm may eventually become common and widely accepted (probably by today's video-game generation), it is not as natural or convenient for the user who frequently

needs to make a quick phone call or needs to just briefly check some e-mail. Similarly, such a design does not achieve the nimbleness or convenience often desired in a professional environment, be it mobile or fixed.

Another possible alternative is to make a SIMON-like device where the display
5 can be detached from the unit and held in the front of the user by the hand opposite
the one holding the phone. An infrared or other wireless link between the phone and
the display would allow data coming over the main handset to be relayed to the
display. Although this design does allow simultaneous viewing/talking, it requires two
10 hands for simple operation and makes pointing or selecting an item from the display
a difficult (possibly three-handed) operation.

Therefore, a need exists for a personal communication device with both a
direct-view display on the device and a projection display view orientation permitting
the user to view the device's display as though the display were a "full screen" display.

SUMMARY OF THE INVENTION

5 The present invention is a device having a direct-view display on a personal communication device and a projection display view orientation permitting the user to view the device's display as though it were a "full screen" display. The present invention may be nimbly-sized to be flexible to accommodate unique user demands in an environment where the user is mobile or fixed, such that the user is required to exert minimal effort, without necessitating the use of two hands, to operate and communicate using the device.

10 One aspect of the present invention device is that the device comprises a single high resolution display, where such display can be used both as a high-resolution direct-view display on the phone and also as a "full-screen" projection display. When operating the present invention, a user may position the phone into a specific mode, such as the "projection display" orientation, whereupon the user's view of the display of the phone appears to be greater than that of the actual display size of the phone. 15 For instance, the high-resolution display and the flip-out mirror, when positioned as such create the optical equivalent of a full-size notebook display at normal reading distance. This dual usage of a single high-resolution display is presented without limitation in the figures herein.

20 The foregoing has outlined rather broadly the features and technical advantages of the present invention in order that the detailed description of the invention that follows may be better understood. Additional features and advantages of the invention will be described hereinafter which form the subject of the claims of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

For a more complete understanding of the present invention, and the advantages thereof, reference is now made to the following descriptions taken in conjunction with the accompanying drawings, in which:

FIGURES 1A, 1B and 1C illustrate the present invention in three modes of operation, from left to right, wherein the present invention is fully-extended, is partly-extended, and is closed;

FIGURE 2 illustrates the present invention, nimbly-sized, in a closed position resting in a user's hand;

FIGURE 3 illustrates the present invention in direct view mode with an exposed touch-pad;

FIGURE 4 illustrates the present invention in a normal phone mode operation with a flip cover open;

FIGURES 5 through 7 illustrate the present invention in various positions in which the device is positioned by a user from a normal mode to a projection viewing mode;

FIGURE 8 illustrates the present invention with the display in a "projection viewing" orientation;

FIGURE 9 illustrates the present invention in a reverse angle orientation wherein the device is in a "projection viewing" mode; and

FIGURE 10 illustrates a viewing using the present invention in a "projection viewing" mode and illustrates the perceived location of the viewed display.

DETAILED DESCRIPTION

In the following description, numerous specific details are set forth such as specific display technologies, etc., to provide a thorough understanding of the present invention. However, it will be obvious to those skilled in the art that the present invention may be practiced without such specific details.

Refer now to the drawings wherein depicted elements are not necessarily shown to scale and wherein like or similar elements are designated by the same reference numeral through the several views.

This application incorporates by reference U.S. Patent No. 5,970,418, which discloses a personal communication device including both audio and a display.

FIGURE 1 illustrates a personal communications device 101 configured in one embodiment of the present invention where a cover 103 is in a closed position, in a manner similarly known in the art as the closed position of a flip phone. The display 102 is directly visible when the phone 101 is closed. Navigation in the display 102 by the user can be controlled using the "touch-pad" 104, which is located just below the display 102.

Other input means could be utilized instead of, or in addition to, touch-pad 104, such as some type of button to operate by a user to move a cursor on display 102. In this mode, device 101 can be utilized by a user as a personal digital assistant, calculator, address book, etc., or could even be utilized as a wireless telephone where a speaker-phone configuration is used to permit the user to converse with another party.

In FIGURE 1B, the display 102 is also visible (while in "direct-view" mode) when the phone 101 is flipped open, i.e., the cover 103 has been opened with respect to the main body of the phone 101. In this mode, a user can use the device 101 as a phone where a speaker 108 is located on an inside portion of cover 103, and a microphone is located somewhere on the main body.

In FIGURE 1C, the device 101 is configured to be in "projection mode", wherein a curved mirror 105 is activated and flips open (the mirrored side is facing the

display 102) and the display 102 moves into a new orientation where it can be viewed in the reflection from the mirror 105 (see FIGURE 9). In both of the open configurations (FIGURES 1B and 1C), the touch-pad 104 (which is now located on the "outside" surface of the phone 101 right behind the speaker 108 at the user's ear) can still be used to navigate a graphical user interface displayed on display 102. In FIGURE 1C, the display 102 and the reflective surface (mirror) 105 are hingably attached to the main body of the device 101, and the cover 502 may also hinge upward for enabling the display 102 to flip up as illustrated. Operation of the device 101 in the mode illustrated in FIGURE 1C is discussed in further detail below.

As in FIGURES 2 and 3, the present invention device is a small handheld device 101 in a form which is generally stylized to be similar to that of a cellular "flip-phone." Additionally, the present invention may include a full cellular phone capability allowing access to the Wide-Area-Network or Internet. Similarly, the device 101, in another embodiment, is limited to a short-range wireless link (such as a Bluetooth link or device) which allows access only to devices in close proximity (such as a PDA or notebook computer). In either case, the device 101 includes a small but very high-resolution display 102 (for example, it might be approximately a 1-inch diagonal, VGA- or SVGA-resolution display) which is visible when the device 101 is in a closed orientation.

In FIGURE 4, the "Open/Direct-View" mode, the device 101 is depicted to be held and operated like a normal phone handset, with a speaker 108 at one end and a microphone 109 at the other end. The display 102 depicts characters of sufficient size to be directly visible and legible to a user (without magnification), and the touch-pad 104 (which is on the surface behind the speaker 108) is still comfortably operable by a user with the index finger while, for example, the user looks at the display 102 and scrolls through a phone directory to select a number to dial.

In an "Open/Projection-View" mode (see FIGURE 1C), the display 102 is repositioned so that it can be viewed through reflective magnification optics 105. In this mode, the small display could show a significant portion or the entirety of the contents of a standard computer screen (or web page, etc.). When the display 102 is

viewed through the reflective magnification optics 105, the user sees the optical equivalent of a much larger display which is positioned at some reasonable reading distance away from the user. The technology for switching to display 102 from the more direct high resolution display illustrated with respect to FIGURES 2-3 to the projection mode illustrated with respect to FIGURES 5-7 is well known in the art. Moreover, the mere act of opening the device 101 into the projection mode as shown in FIGURES 5-7 could activate a mechanical switch whereby the display device switches from a high resolution display of information directly to a user to the projection mode as noted above.

In FIGURES 5 through 7, the transition from the Open/Direct-View mode to Open/Projection-View mode is accomplished by a) having a viewing mirror 105 flip open, b) laying the display cover assembly 502 open to provide clearance, and c) having the display 102 itself rotate approximately 70-90 degrees, as shown in sequence in the Figures.

In FIGURE 8, when the device 101 is in this configuration, it may be easily operated by a user such that a user may hold the device 101 up to the user's ear like a normal phone. In this configuration, referring to FIGURE 10, the user can comfortably look into the mirror 105 and see the reflected and highly magnified image 1001 of the display 102, enabling viewing of "full-screen" content in a compact device. The touch-pad 104, which is on the rear surface of the cover 502 behind the speaker 108, can comfortably be reached and operated using the index finger of the hand which is holding the phone 101.

From each of the FIGURES, the present invention allows the phone device 101 to be nimbly-sized and extremely thin when in a closed mode, such that the display 102 remains in an easily viewable location when closed. Additionally, in the projection viewing orientation, a second orientation configuration is positioned wherein the display 102 rotates approximately 90 degrees for use in projection mode, as illustrated in FIGURE 9.

Software for flipping the displayed image 90 degrees is well known in the art. As depicted in the various figures, the present invention is shown to be operative in

three different modes: a) Closed/Direct-View, b) Open/Direct-View, and c) Open/Projection-View, although other modes are envisioned.

Key attributes of the present invention include but are not limited to following:

1) the present invention incorporates a single display for both direct-viewing mode and projection-viewing mode;

2) the present invention provides convenient direct-viewing access in two different configurations - with the "lid" closed or open;

3) the present invention provides for a much thinner package through the use of a pivoting or rotating display which lays flat in direct-viewing modes but which rotates significantly for projection-viewing mode; and

4) the present invention provides a single touch-pad which can be comfortably accessed in all 3 operating modes (although different coordinate "transformations" are required to compensate for the change in orientation of the touch-pad relative to the display image), and regardless of whether the phone is being held by the right hand or the left hand.

Although the present invention and its advantages have been described in detail, it should be understood that various changes, substitutions and alterations can be made herein without departing from the spirit and scope of the invention as defined by the appended claims.